THA revision with extensively porous-coated stems

32 hips followed 2–6.5 years

Tsuneto Sugimura[1] and Atsumu Tohkura[2]

Since 1991, we have used 32 extensively porous-coated femoral stems with cylindrical distal cross-section for revision of failed cemented stems. At an average follow-up of 4 years, one stem had been re-revised due to a periprosthetic femoral fracture, but no aseptic loosening has been observed. The average postoperative Harris Hip Score was 84 points. Radiographically, 23 stems were well fixed with bone-ingrowth, which was mostly observed in the distal portion of the porous coating. Increased thickness and density of the thin cortical wall was also seen. Mild stress shielding was present in 4 cases, but was not progressive and gave no symptoms. An extensively porous-coated stem, with a cylindrical distal cross-section, seems to be a reasonable choice in femoral revision.

Departments of Orthopedics, [1]Inuyama Chuo Hospital, Inuyama, Aichi, Japan and [2]Chubu Rosai Hospital, Nagoya, Aichi, Japan. Correspondence: Dr. Tsuneto Sugimura, Department of Orthopedics, Inuyama Chuo Hospital, 6 Futagozuka, Goromaru, Inuyama-City, Aichi, 484-8511, Japan. Tel +81 568 62-8111. Fax -9289
Submitted 97-03-22. Accepted 97-09-12

Since 1991, we have performed THA revisions using extensively porous-coated femoral components without cement. We report the outcome of 32 cases.

Patients and methods

Between 1991 and 1995, we performed 32 cementless revisions for failed cemented stems in 30 patients (10 men). The prosthesis used was the AML 5/8-coating collared stem (DePuy, Warsaw, Indiana), which is extensively porous-coated with a cylindrical distal cross-section. The mean age at revision was 64 (49–82) years. The indications for the primary arthroplasty were arthrosis (15), primary femoral head necrosis (8), necrosis after femoral neck fracture (6) and rheumatoid arthritis (1). The duration of the cemented stems at the time of revision was 8 (1.2–18) years. The reason for all revisions was aseptic loosening. This was the first revision in 18 hips, the second in 11 and the third in 3. We followed all of the patients for an average of 4 (2–6.5) years.

The preoperative and the latest Harris (1969) Hip Scores were noted. In the radiographic analysis, we recorded the grade of preoperative bone deficiency (Gustilo and Pasternak 1988), the cortical ratio, subsidence of the prosthesis and periprosthetic bone reaction according to Engh et al. (1990). Comparisons were made between the first and the last postoperative A-P radiographs. Subsidence was calculated from the distance between the stem collar and the lesser trochanter. The area of bone ingrowth, seen as a densification of the cortex and bridging between the cortex and the prosthesis, was noted in each of the 7 Gruen zones (Gruen et al. 1979). Stress shielding was recorded.

For statistical evaluation, the Mann-Whitney U-test was used for comparison of two groups, and a test for trend in the contingency table. Data were analyzed by use of StatView SE.

Results

Among the 32 hips, 1 stem has been rerevised due to a periprosthetic femoral fracture.

The prerevision Harris Hip Score averaged 52 points. At the latest follow-up, the average score had improved to 84 points ($p = 0.0001$). Based on Gustilo's bone deficiency grades, the average hip scores at follow-up were 89 points in type I (20 hips), 77 in type II (10 hips), and 69 in type III (2 hips). The differences between these types were statistically significant ($p < 0.02$). Radiographically, the cortical ratio of the proximal, middle and distal femur increased over time (Table 1). 23 femoral stems were fixed with apparent bone ingrowth and 9 were judged as stable fibrous fixation. There was a subsidence of an average

Table 1. Changes in cortical ratio

	Postoperatively	At follow-up
Proximal	19	21
Middle	28	29
Distal	34	36

Table 2. Number of hips with bone ingrowth by zone at follow-up

	1	2	3	4	5	6	7	Total
n	1	4	13	0	14	5	1	38 [a]

[a] Bone ingrowth was seen in 38 zones in 23 bone-ingrown hips

of 3 (1–4) mm in 9 hips. No aseptic loosening was observed.

Most of the bone ingrowth was seen in Gruen's zones 3 and 5 (Table 2 and Figure). Stress shielding was noted in 4 hips, but was not progressive, and was asymptomatic (average hip scores 82 points). 3 of 4 were first-time revisions and were graded as Gustilo's type I.

Bone ingrowth is seen around the distal portion of the porous coating of the stem. Most of the bone ingrowth (27/38 instances) was seen at this site.

Discussion

We found that the grade of preoperative bone deficiency affected the clinical results. The results of cementless THA revision, using extensively porous-coated stems, have been encouraging. Engh et al. (1988) noted 86% optimal fixation. Lawrence et al. (1993) reported 88% stable implants with osseointegration. Moreland and Bernstein (1995) observed bone ingrowth in 83%. The outcome for our patients approached these in the clinical and radiographic evaluations. Bone ingrowth was mostly achieved in the distal portion of the porous coating. These findings suggest that fixation of the prosthesis in the distal, intact portion of the femur is the key to success in cementless THA revision.

In previous publications, concern has been expressed about stress shielding, when using extensively porous-coated stems. We found stress shielding in 4/32 hips. This incidence is lower than that previously reported (Engh et al. 1990, Moreland and Bernstein 1995). 3 of these 4 hips were first-revision cases, and were graded as Gustilo's type I. We suggest that the incidence of stress shielding may be lower in revisions, especially in bone-deficient cases, since the bony repair process may dominate over the resorption caused by stress shielding. In our study, some degree of increase in the cortical ratio was observed—i.e., reconstitution of the thin cortical wall to increased thickness and density. We believe that the use of an extensively porous-coated stem in THA revision will prevent further bone loss, possibly even improve bone stock, and that this technique is a reasonable choice in bone-deficient cases.

References

Engh C A, Glassman A H, Griffin W L, Mayer J G. Results of cementless revision for failed cemented total hip arthroplasty. Clin Orthop 1988; 235: 91-110.

Engh C A, Glassman A H, Suthers K E. The case for porous-coated hip implants. The femoral side. Clin Orthop 1990; 261: 63-81.

Gruen T A, McNeice G M, Amstutz H C. "Modes of failure" of cemented stem-type femoral components. A radiographic analysis of loosening. Clin Orhtop 1979; 141: 17-27.

Gustilo R B, Pasternak H S. Revision total hip arthroplasty with titanium ingrowth prosthesis and bone grafting for failed cemented femoral component loosening. Clin Orthop 1988; 235: 111-20.

Harris W H. Traumatic arthritis of the hip after dislocation and acetabular fractures: Treatment by mold arthroplasty. An end-result study using a new method of result evaluation. J Bone Joint Surg (Am) 1969; 51: 737-55.

Lawrence J M, Engh C A, Macalino G E. Revision total hip arthroplasty. Long-term results without cement. Orthop Clin North Am 1993; 24: 635-44.

Moreland J R, Bernstein M L. Femoral revision hip arthroplasty with uncemented, porous-coated stems. Clin Orthop 1995; 319: 141-50.